Final Technical Report

Collaborative Research with University of Nevada and USGS: Seismic Hazard and Fault Mechanics in the Ruby Mountains

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TECHNICAL ABSTRACT

The geomorphology of the range front and the offset of Quaternary deposits along the northwestern side of the Ruby Mountains and East Humboldt Range, in northeastern Nevada, provide evidence for active normal faulting on the Ruby Mountains fault zone. The 73 km-long fault trace is expressed as three geometric segments each separated by a left step 3 to 5 km wide. The increase of scarp heights in Quaternary deposits of progressively greater age at sites along of the Ruby Mountains fault zone indicates continued fault movement throughout the Quaternary. Offsets of glacial outwash deposits of the Angel Lake glaciation are interpreted to indicate a Holocene age for the last earthquake movement along the fault. The most recent event may have extended the entire 73 km length of the fault zone with vertical separation of offset surfaces ranging between about 1 and 3 meters, equivalent to a Mw 7.3 to 7.6 earthquake. A 16 ± 5 m vertical separation of 161 ± 33 kyr old Lamoille glacial provides the basis to estimate the fault slip rate. It has previously been suggested that the fault is characterized by a dip as low as 20°. We did not observe exposures of fault dip near or adjacent to offset Quaternary surfaces, but the suggestion of low-dip is consistent with our observations that the range front and triangular facets along the fault zone are characterized by a particularly low slope (14-24°). When it is assumed that the fault dips steeply at 60°, the uplift rate is equivalent to a fault slip rate of 0.15 ± 0.07 mm/yr. If the fault is characterized by a 20° dip, the fault slip rate is greater than 1 mm/yr. Dividing the offsets of the Angel Lake outwash (1.13 ± 0.13 m) by the slip rate (0.15 ± 0.07 mm/yr) gives an estimate of earthquake recurrence interval 12,777 ± 8,313.

NON-TECHNICAL ABSTRACT

The geomorphology of the range front and the offset of Quaternary deposits along the northwestern side of the Ruby Mountains and East Humboldt Range, in northeastern Nevada, provide evidence for active normal faulting on the Ruby Mountains fault zone. Prior studies have suggested that the fault zone may be characterized by a particularly low dip-angle. Understanding the dip-angle and the consequence of such dip-angles on the characteristics of potential earthquake size and variations in earthquake recurrence is of fundamental importance to assessing seismic hazard over broad regions of the western United States. We conducted a field study of offset deposits and geomorphology along the fault zone to collect data bearing on the style and rate of earthquake recurrence along the fault zone.. Our study revealed a number of observations that place limits on the rate of fault slip and are consistent, though do not prove, the presence of low-angle faulting along this rangefront. Our observations will later be combined with high-resolution seismic reflection measurements to measure the fault dip in the shallow subsurface.